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New Canadian Black Flies (Diptera: Simuliidae).¹

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The following descriptions of new species of black flies are based on material acquired from several sources in the Division of Entomology. The largest collections were made by field parties engaged in the Northern Insect Survey, a project commenced in 1947 and conducted by the Division in co-operation with the National Defence Research Board. Much of the simuliid material accumulated by this survey still remains to be examined and it will be several years before the valuable data on species distribution that it contains can be assembled into a form suitable for publication. Several collections of northern material have also been contributed by officers of the Household and Medical Entomology Unit. The rest of the material is the outcome of my own field studies in the Ottawa district. These studies, commenced in 1949 and still continuing, are on a much smaller scale than the northern work and are designed chiefly to increase my knowledge of the group and to verify or supplement certain aspects of the work done by Twinn (1) in this area.

Selected paratypes of all the species are deposited in the United States National Museum. The material from Alaska, which was loaned by the same institution, is also deposited there.

Prosimulium vernale n. sp.

A very large dark-brown to black form, the female with narrow frons, infumated wing membrane, and short, stout, basal tooth on the tarsal claw. Length of body, male 3.5 mm., female 4 mm. Length of wing, male 4 mm., female 5-5.25 mm.

Female.—Head black, with brown or grey pollinosity. Frons narrow, at vertex barely one-fifth and at antennae less than one-tenth as wide as head, with moderately long, decumbent, golden pile interspersed with a few longer, more erect, black hairs. Face strongly convex, as wide as long, about four times as wide as the lower frons, with appressed, convergent, golden pile and much longer, more erect, black hairs which are proclinate below. Occiput with golden pile and sparse fringe of black hairs. Antenna 11-segmented, dark brown with black hairs, evenly tapered from third segment; basal two or three segments lighter brown with paler hairs. Palpus black with black hairs; third segment greatly enlarged.

Thorax black or dark brown. Pronotum lighter brown. Mesonotum uniformly dark grey- or brown-pollinose with humerus anteriorly paler; pile golden, moderately long, somewhat matted, not uniformly decumbent, mixed with darker hairs laterally and posteriorly. Scutellum black or brown, with long, erect, golden pile mixed with darker hairs behind. Postnotum subshining, grey-pollinose. Pleuron dark brown with paler membrane, grey-pollinose; hair tufts golden (lateral pronotal tuft with mixed golden and black hairs). Haltere light brown with pale-golden hairs. Wing membrane noticeably fumose; veins dark brown or black; hairs entirely black, those on stem vein occasionally paler at tips; basal

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cell present. Legs brown, densely covered with decumbent golden pile which is longer and more erect on dorsal and posterior surfaces of anterior femur, apex of hind femur, and dorsal surface of hind tibia; black hairs sparsely and evenly distributed over the legs, more numerous on the dorsal surfaces and on the tarsi. Hind metatarsus five times as long as wide. Calcipala and pedisulcus absent. Claw strongly curved, with short, mammiform basal tooth.

Abdomen dark brown, subshining; narrow posterior margins of tergites paler; intermediate tergites greatly constricted. Pile golden, much longer and denser on pleural membrane than elsewhere, with scattered black hairs present, especially posteriorly. Basal fringe long. Genitalia as in Fig. 1, A, B. Anal lobe short, somewhat produced ventrally. Arm of the genital fork slender at base, greatly expanded from about the middle, where a slender, spatulate, apically denticulate process arises on the inner side.

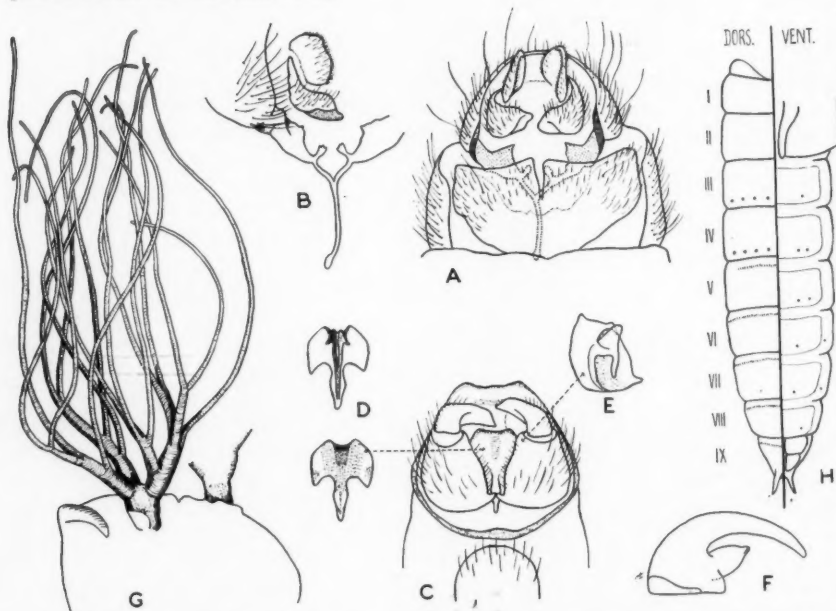


Fig. 1. *Prosimulium vernale* n. sp. (Bell's Corners, Ont.) A. Tip of female abdomen, ventral view. B. Female genitalia dissected, showing genital fork attached to left side of ninth tergite, and left anal lobe and cercus. C. Tip of male abdomen, ventral view. D. Ventral plate of aedeagus, anterior (below) and posterior views. E. Right coxite, posterior view showing basal apodeme. F. Female tarsal claw. G. Left respiratory organ of pupa, postero-lateral view. H. Diagram of pupal abdomen, showing hooklet pattern.

Male.—Colour generally as in female, but dorsum of thorax and abdomen darker, the former dark-brown-pollinose with traces of dark-reflecting dorso-central vittae behind. Pile of mesonotum and sometimes of anterior surfaces of legs golden, elsewhere much darker, mostly black or brown with golden reflections, or with tips of the hairs golden. Fringes of calyptere and alar lobe pale golden. Abdominal tergites broad, shining; lateral pile of third and fourth segments long and erect. Genitalia as in Fig. 1, C-E. Base of coxite laterally with a large, truncate apodeme having a long, slender, anterior process. Style shorter than coxite, abruptly bent inward near its base, tapered near apex to a

pointed but not spinous tip. Ventral plate with long basal process, posterior surface with a double keel bearing two small prongs.

Pupa (Fig. 1, G, H).—Length of body 5-5.5 mm., of respiratory organ 4 mm. Latter consisting of 16 filaments arising from three main trunks, as in *Prosimulium birtipes* (Fries) except that, on the dorsal main trunk, the inner fork carries five and the outer fork three filaments. In *birtipes* this arrangement is reversed. In *birtipes*, also, the four filaments that arise from each of the other two main trunks are frequently arranged in two uniform pairs, whereas in *vernale* n. sp. this seems to be seldom the case, the filaments being given off singly at regular intervals from the base of each trunk. Lateral hooklets on venter of seventh segment and those on venter of eighth sometimes absent, on the latter always minute. Caudal hooks long and strong. Cocoon a short, thinly woven sock covered with fine silt particles, enclosing only the abdomen.

Holotype, ♀, Bell's Corners, Ont., 9 May 1950. G. E. Shewell. Emerged into a cage trap. No. 5987 in the Canadian National Collection, Ottawa.

Allotype, ♂, 5 May 1950, otherwise same data.

Paratypes, 58 ♂♂, 74 ♀♀ pinned; many adults, pupae, and pupal skins in alcohol; 5-14 May 1950, otherwise same data as type. Pupae taken on 5 May on debris in the stream near the cage.

Other material: 1 ♀, Bell's Corners, Ont., 19 May 1949, G. E. Shewell (cage trap). 1 ♂, 1 ♀, C.P.H.², Ashton, Ont., 7 and 13 May 1950, G. E. Shewell (cage trap). 1 ♂, 1 ♀, C.P.H.¹, Stanley Corners, Ont., 4 and 7 May 1950, G. E. Shewell (cage trap).

This species, which is perhaps the earliest black fly to emerge in the Ottawa district, is comparable in size to *Prosimulium magnum* D. & S, from which it is distinguished at a glance in the female by the much narrower frons and in both sexes by the entirely black-haired wing veins. It has also, in general, darker-coloured pile and a darker cast over the integument.

The type locality of *P. vernale* is a small shallow stream draining an extensive swamp and wooded area in the flat farmland south of Ottawa. Unless the season is unusually wet, the stream bed dries up by about the end of June. When a cage trap was placed in the water on May 5, emergence of *vernale* had already begun. It reached its peak in the following three or four days and ceased after the capture of a single specimen on May 14. Emergence of males preceded that of females by a day or two. It must be assumed that eggs are laid in the stream during this period and that they lie in the moist silt of the stream bed until early the following year. Larvae have not yet been taken, but they must be present very early, perhaps as soon as thawing provides a trickle of water under the snow. The spring freshet is strong but not turbulent. Bedrock is close to the surface of the ground, but the stream bottom is heavily silted and supports a dense mat of water moss, *Fontinalis lescurii* Sull.; clumps of mint, *Mentha arvensis* L.; and other swamp plants that, with the advancing season, gradually retard the flow of water and choke the stream's course until, by midsummer, it is in many places indistinguishable from the surrounding swampland. In the brief season of its activity, this stream supports a remarkably diverse black fly fauna.

The following list of species, with dates of their appearance, is based on collections from the cage trap during two consecutive years. *Prosimulium vernale*, n. sp., 5-14 May; *P. gibsoni* Twinn, 9-21 May; *P. multidentatum* Twinn, 13-21 May; *P. decemarticulatum* Twinn, 13-31 May; *Cnephia mutata* (Mall.), 18-23 May; *Eusimulium innocens* n. sp. (described in this paper), 19 May-10 June; *Simulium perissum* D. & S., 19-25 May; *S. venustum* Say, 25-30 May; *Eusimulium*

²Twinn, 1936, p. 111.

croxtoni N. & M., 25 May-9 June; *Eusimulium*, 2 spp. undetermined, 25 May-1 June.

***Cnephia eremites* n. sp.**

Eusimulium species A, Twinn *et al.*, 1948, *Canadian J. Res.*, D, 26: 352. A medium-sized, dull, dark-brown to black species with pale-golden thoracic pile and lightly fumose wings. Claws with distinct, short, basal tooth. Length of body 2-3 mm., of wing 2.5-4 mm.

Female.—Head dull black with dark-grey pollinosity, pile pale golden with sparse, black occipital fringe. Frons at antennae barely a fourth as wide as head, widening above. Face wider than high, pile reclinate. Antenna and palpus dull black; former 11-segmented, normal.

Thorax mainly black with dark-grey or brown pollinosity. Mesonotum with humerus and postalar callus dark brown, pale vittae barely noticeable, merging behind with the pale prescutellar area; pile pale golden, moderately dense, evenly decumbent on disc, posteriorly with a few black hairs. Scutellum with pale-golden pile and long black hairs, all incurved. Postnotum subshining, grey-pollinose. Pleuron with membranous areas dark brown, tuft pale golden with a few darker hairs. Haltere dark brown. Wing membrane a little clouded; veins black, hairs on stem vein and base of costa mixed black and pale golden, elsewhere black; apex of radial sector sometimes indistinctly furcate; basal cell present. Legs dull black or dark brown, robust, with pale-golden pile except at apices of coxae, femora, and tibiae, where the hairs tend to be black. Calcipala minute. Pedisulcus a very slight crease. Claws moderately long, slightly curved, with short, stout, subbasal tooth.

Abdomen black or dark brown, subshining, with apical two segments and posterior margins of others often paler above. Pile, including moderately long basal fringe, pale golden, short and sparse above, much longer, denser, and sometimes noticeably darkened on pleural membrane and below. Intermediate tergites slightly constricted, the ninth not produced snout-like. Genitalia as in Fig. 2, A, B. Cercus distinctly notched. Anal lobe long and narrow.

Male.—Somewhat darker than female with less extensive brown areas on thorax and abdomen. Pile pale golden on mesonotum, propleuron, fringes of calyptere and posterior wing lobe, and ventral surfaces of femora, tibiae, and metatarsi, elsewhere black or dark brown. Abdomen with dorsal pile longer than in female, pleural membrane with only sparse hairs. Hind metatarsus four-fifths as wide as tibia. Genitalia as in Fig. 2, C-E. Style broad, flat, sickle-shaped, with minute apical spine. Aedeagus with internal, curved, strap-like process (*median sclerite* of Freeman (3) ?) arising from the ventral plate.

Pupa (Fig. 2, G, H).—Length of body 3-4 mm., of respiratory organ 2-2.5 mm.; latter consisting of a short, bulbous base from which arise nine or ten branches, one from the centre, the others evenly spaced on the perimeter. Each branch bearing two to five filaments. The branching not constant and the total number of filaments 22-30. Central branch usually with four filaments. Posterior hooklets on dorsum of second and venter of fourth segments minute. Caudal hooks well developed. Cocoon a thinly woven, irregular sock frequently covering only the abdomen.

Holotype, ♀, Coral Harbour, Southampton Island, N.W.T., 22 July 1948. G. E. Shewell, Expt. No. S48718-39. Reared from pupa collected 18 July. No. 5988 in the Canadian National Collection, Ottawa.

Allotype, ♂, Expt. No. S48718-15, otherwise same data.

Paratypes, 76 ♂♂, 32 ♀♀. Same data as types. Also many ♂♂, pupae, and larvae collected at same time and place.

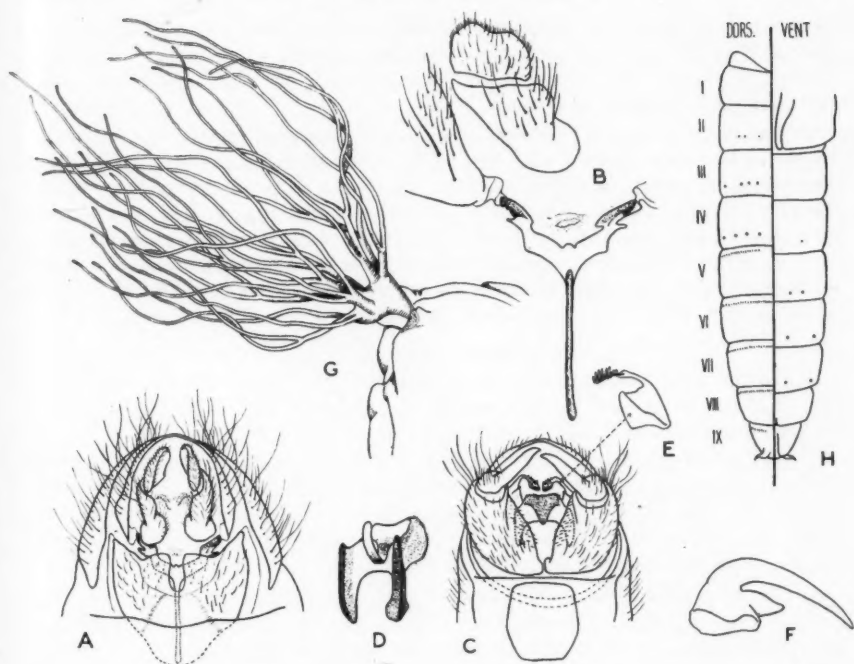


Fig. 2. *Cnephia eremites* n. sp. (Coral Harbour, Southampton Isl., N.W.T.) A. Tip of female abdomen, ventral view. B. Female genitalia dissected, showing genital fork attached to left side of ninth tergite, and left anal lobe and cercus. C. Tip of male abdomen, ventral view. D. Ventral plate of aedeagus, postero-lateral view showing strap-like process. E. Right paramere of aedeagus. F. Female tarsal claw. G. Left respiratory organ of pupa, posterior view. H. Diagram of pupal abdomen, showing hooklet pattern.

Other material: NORTHWEST TERRITORIES. Many ♂♂, ♀♀, pupae, larvae, Chesterfield, Hudson Bay, 12 July-18 Aug. 1950, J. G. Chillcott (adults reared from several streams in the area). 7 ♂♂, 2 ♀♀, Reindeer Depot, Mackenzie Delta, 7-11 July 1948, J. R. Vockeroth. MANITOBA. Many ♂♂, ♀♀, Churchill, 6-12 July 1947, C. R. Twinn (reared, expt. nos. FSB-ME and FSB-E, pupal skins preserved); 6 July 1947, B. Hocking; 27 June-1 July 1948, L. A. Miller (reared from several streams in the area). ALASKA. Many ♂♂, ♀♀, pupae, larvae, College, 5 June-12 July 1948, Alaska Insect Project (adults reared or trapped).

This species is closely related to *Cnephia lasciva* (Twinn). The structure of the genital organs in both sexes, the tendency to furcation of the radial sector, the shape of the female tarsal claw, the shape of the pupal respiratory organ and the arrangement of its filaments, also the structure and pattern of the larval head capsule, all indicate this affinity. It is, however, a noticeably darker species with much less evident thoracic vittae. The male claspers are not quite so stout as in *lasciva*; the female lacks the snout-like prolongation of the ninth tergite and has a larger basal tooth on the claw.

The pupae have the peculiar clustering habit noticeable also in *Cnephia lasciva* and in some species of *Prosimulium*, the cocoons being inextricably matted together on the rock, twig, or other surface to which they are attached, the pupae sometimes lying flat several layers deep or else protruding almost vertically

so that it is impossible to separate any single cocoon from its neighbours. This condition seems to be voluntary and not the outcome of overpopulation of the habitat, for large areas of apparently suitable rock or other surface frequently surround such colonies.

The type locality of *eremites* is a small stream draining the south end of a large, shallow lake about a mile east of Kathleen Falls on the Kirchoffer River. The stream is about three feet deep and 18 inches to two feet wide, with overhanging banks of carex marsh and a bed of very fine gravel. At two places in its course, where the bed has become cluttered with boulders, thereby greatly increasing the rate of flow, larvae and pupae were found in large numbers. Adults were obtained by sweeping dwarf willow bushes and other herbage on the banks of the stream. There was no indication that this species attacks man.

Eusimulium innocens n. sp.

A very small, dark species, the male entirely black-haired, the female with very narrow frons and strong basal tooth on the claw. Pedisulcus weak or absent. Length of body 1.5-2.0 mm., of wing 2.0-2.5 mm.

Female.—Head black with uniform pale-grey pollinosity, and white pile. Frons very narrow, almost parallel-sided, at its widest point not more than one-twelfth as wide as head. Face four times as wide as frons, a little longer than wide, the pile reclinate or incurved. Antenna dull black, sometimes brownish basally, 11-segmented, normal. Palpus dull black.

Thorax mainly black. Mesonotum with postalar declivity and sometimes the humerus brownish, the disc brown-pollinose with fairly dense, decumbent, pale-golden pile, the sides and posterior margin pale-grey-pollinose with white pile. Scutellum brown, obscurely grey-pollinose, the long, erect, marginal pile white with a few darker hairs. Postnotum subshining, faintly grey-pollinose. Pleuron with wing-base and sometimes mesopleural membrane brownish, grey-pollinose; hair tufts white. Haltere white or pale yellow, base brown. Wing hyaline, veins pale, hairs and spinules black, subcosta haired beneath, basal cell absent. Legs brown, with faint grey or brown pollinosity. Pile of coxae, trochanters, femora, and tibiae white or pale yellow, but a few outstanding black hairs on dorsal surface of posterior femur. Tarsi with light-brown hairs, the ventral spinules and a scattering of dorsal hairs black. Calcipala small. Pedisulcus absent, or present as a slight crease.

Abdomen dark brown, faintly brown-pollinose, tergites only moderately developed, sternites membranous. Pile long and dense, especially on pleural membrane, white or pale yellow with a few black hairs on apical two or three segments. Genitalia as in Fig. 3, B.

Male.—Almost entirely black, faintly grey-pollinose, pile wholly black. Mesonotum in dorsal view deep velvet-black, the disc obscurely brown-pollinose. Scutellum light brown. Pleuron with brownish membranous areas. Hind metatarsus not much enlarged, nearly four times as long as wide. Abdomen velvet-black above. Genitalia as in Fig. 3, C, D. Style rather long, slender, evenly curved, terminating in a minute, blunt tooth.

Pupa (Fig. 3, F).—Length 2.5-3 mm. Respiratory organ longer than pupa, consisting of ten slender filaments arising from three main trunks, the upper with four, the lower two each with three branches. Dorsal main trunk short, giving rise to two equal, long-petiolate pairs of filaments. Lower two trunks much longer, the outer one producing a single ventral filament and a long-petiolate pair of dorsal filaments, the inner one producing a single lateral filament and a long-petiolate pair of mesal filaments. Abdominal hooklets as in Fig. 3, G.

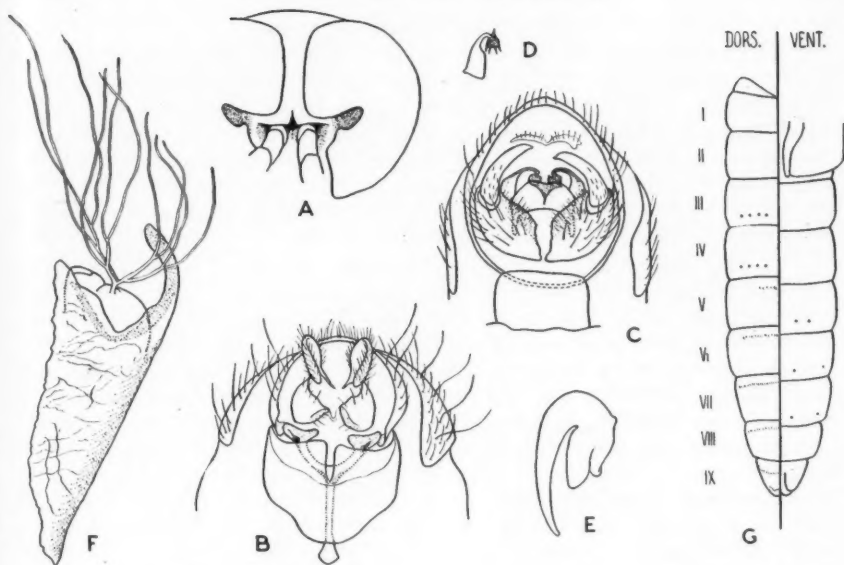


Fig. 3. *Eusimulium innocens* n. sp. (Bell's Corners, Ont.) A. Head of female, frontal view. B. Tip of female abdomen, ventral view. C. Tip of male abdomen, ventral view. D. Left paramere of aedeagus. E. Female tarsal claw. F. Pupa within cocoon, showing left respiratory organ only. G. Diagram of pupal abdomen, showing hooklet pattern.

Caudal hooks small. Cocoon slipper-shaped with a long, curved, dorsal anterior process, which is sometimes nearly as long as the rest of the cocoon.

Holotype, ♀, Bell's Corners, Ont. G. E. Shewell. Rearing No. F5, collected 2 June, emerged 6 June 1950 (D. P. Gray). Pupal skin preserved in alcohol. No. 5989 in the Canadian National Collection, Ottawa.

Allotype, ♂, rearing No. K4, collected 7 June, emerged 11 June 1950. Otherwise same data.

Paratypes, 13 ♂♂, 9 ♀♀, 19 May-9 June 1949, 2-10 June 1950; 5 pupae, 140 larvae, 18-27 May 1950. All from the type locality. Eight adults reared individually, the rest taken in a cage trap. Pupae and larvae taken from the stream in or near the cage.

Other material: 1 ♀, Trenton, Ont., 9 June 1912, Evans.

Despite the absence of a well-defined pedisulcus, this species, by its small size and general habitus, as well as by the characters of the immature stages, is considered to be a true *Eusimulium*.

The larvae develop in the normal way in small colonies on grass blades trailing in the current just beneath the water surface. However, on reaching maturity, they drop off and sink to the moss (*Fontinalis lescurii* Sull.) covering the stream bed. Here the pupae are found only with great difficulty, as the cocoons with their dorsal extensions greatly resemble the tiny, spiked leaves of this plant. There is no evidence that this species bites man. It is perhaps rare and of local occurrence. For further notes see under *Prosimulium vernale* n. sp. above.

Eusimulium furculatum n. sp.

Eusimulium species B, Twinn *et al.*, 1948, *Canadian J. Res.*, D, 26: 353. A small to medium-sized, black or dark-gray species with mostly pale-golden or white pile, the claws simple. Length of body 2-3 mm., of wings 2.5-3.3 mm.

Female.—Head black, pollinosity grey, paler on frons and face, pile white or very pale golden with sparse, black, occipital fringe. Frons at antennae nearly one-quarter as wide as head, widened above. Face a little wider than long, slightly wider than frons at vertex, pile mostly proclinate or incurved. Antenna and palpus dull black; former 11-segmented, normal.

Thorax mainly black. Pronotum dark brown, lateral tufts pale golden. Mesonotum black; humerus sometimes dark brown; disc obscurely brown-pollinose with dense, decumbent, pale-golden pile, sides and posterior margin grey-pollinose with paler, almost white pile. Scutellum with long, erect, pale-golden pile sometimes mixed with black hairs on margin. Postnotum subshining, faintly brown-pollinose. Pleuron sometimes dark brown on membrane, grey-pollinose, tuft usually pale golden, sometimes darker, almost brown. Haltere knob white or pale brown, base dark brown. Wing hyaline; veins pale yellow; hairs on stem vein and base of costa pale yellow, elsewhere black; subcosta sparsely haired beneath; basal cell absent. Legs black, obscurely grey-pollinose, pile white or pale golden. Antero-dorsal surfaces of tibiae with denser pollen, but silvery reflections from these surfaces caused less by the intensity of pollination than by the increased length and density of the hairs covering them. Tarsi black-haired, basal two segments of anterior tarsus slightly compressed, hind metatarsus five and a half to six times as long as wide. Calcipala very small. Pedisulcus deep. Claws simple, small, moderately curved.

Abdomen dark brown, obscurely brown-pollinose. Tergites moderately broad, slightly constricted on intermediate segments. Sternites anterior to seventh not developed. Pile, including basal fringe, very pale golden with a few longer, black hairs apically. Genitalia as in Fig. 4, A. Anal lobe with slight antero-ventral enlargement and acute ventral projection. Arm of genital fork in ventral view with distinct, rounded shoulder on inner side, opposite which is a strong, blunt tooth.

Male.—Head, including antennae and palpi, black, sparsely grey-pollinose; pile black. Mesonotum in dorsal view deep black, in oblique anterior view grey- or brown-pollinose with faint, paler vittae on posterior half; middle vitta linear, lateral ones slightly broader; pile long, pale golden, shorter and less dense on disc, sometimes with a few darker hairs posteriorly. Haltere black, with tip of knob pale. Pile of pleuron, scutellum, base of costa, and stem vein variable, usually darker than in female, sometimes all black but the hairs often pale at tips or entirely pale golden. Legs black or deep brown, pile variable; coxae, trochanters, dorsal and posterior surfaces of femora usually all black-haired. Abdomen black or deep-brown, obscurely brown-pollinose, pile black, sparse on pleural membrane, sometimes the basal fringe pale, at least apically. Genitalia as in Fig. 4, B-D. Style short, not much longer than broad, tip abruptly bent backward and inward so that, in ventral view, the structure appears broadly truncate. Aedeagus with an internal, slender, furcate, *median sclerite* connecting the ventral plate with a T-shaped sclerotized area on its dorsal surface. Membrane of aedeagus with extensive area of microscopic rugosity.

Pupa (Fig. 4, F).—Length 3-3.5 mm. Respiratory organ as long as pupa, with eight filaments arising from three main trunks, the dorsal trunk bifurcate and short-petiolate, the other two each producing three filaments. Final branching of median trunk occurring on the upper filament, that of the ventral trunk

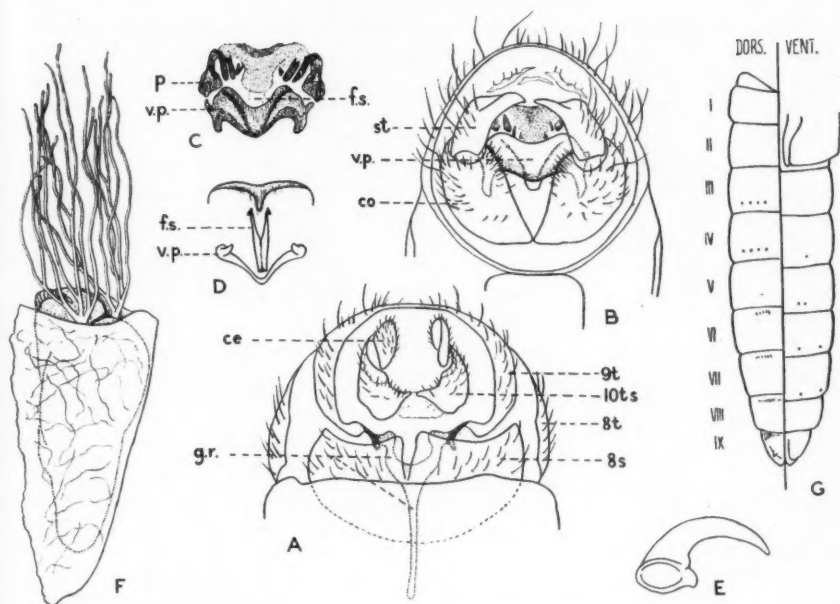


Fig. 4. *Eusimulium furculatum* n. sp. (A-E, Churchill, Man.) A. Tip of female abdomen, ventral view. B. Tip of male abdomen, ventral view. C. Aedeagus, postero-ventral view. D. Aedeagus, internal (dorsal) view, showing forked sclerite and sclerotized area on posterior surface. E. Female tarsal claw. (F-G, Whitehorse, Yukon). F. Pupa within cocoon, dorso-lateral view, both respiratory organs shown. G. Diagram of pupal abdomen, showing hooklet pattern. (ce, cercus; co, coxite; f.s., forked sclerite; g.r., genital rod (9th sternite); p, paramere; st, style; v.p., ventral plate; 8s, 8th sternite; 8t, 8th tergite; 9t, 9th tergite; 10ts, 10th tergosternite).

on the lower filament. Branchings of both these trunks variable in their distance from the base. Abdominal hooklets arranged as in Fig. 4, G, those on venter of fifth to seventh segments bifid. Caudal hooks present but small. Cocoon slipper-shaped, closely woven, with distinct, convex protrusion of anterior rim above.

Holotype, ♂, Goose River, Churchill, Man., 9 July 1947. C. R. Twinn. Reared. No. 5990 in the Canadian National Collection, Ottawa.

Allotype, ♀, 10 July 1947, otherwise same data.

Paratypes, following specimens from Churchill: 3♂♂, 9♀♀, many pupal skins, 9-14 July 1947. C. R. Twinn (vials containing skins bear data "FSB-GR" [Goose River] and "FSB-CR" [Churchill River]. All adult types are certainly from skins having the former data, but were not reared individually). 1♂, 1♀, 17 July 1948, B. Hocking. 4♂♂, 9♀♀, 26 June, 21-22 July 1948, L. A. Miller (all specimens individually reared and preserved with their pupal skins).

Other material: NEWFOUNDLAND. 2♀♀, Goose Bay, Labrador, 13 July 1950, B. Hocking. QUEBEC. 92♀♀, Ft. Chimo, 27 July-16 Aug. 1948, H. N. Smith and R. H. MacLeod. 18♂♂, 21♀♀, 4 larvae, Pt. Harrison, 25 June-22 July 1949, D. P. Whillans and P. J. Lachaine. 3♀♀, Gt. Whale River, 31 July-28 Aug. 1949, J. R. Vockeroth. NORTHWEST TERRITORIES. 2♂♂, 2♀♀, Baker Lake, 9-10 Aug. 1949, R. Gwatkin. 1♀ (reared), Padley, 17 Aug. 1950, R.

Hennigar. 25 ♂♂, 3 ♀♀, Kidluit Bay, Richards Isl., 25-26 July 1948, J. R. Vockeroth. YUKON. Many pupae, Lewes River, Whitehorse, 17 July 1948, C. R. Twinn; 27 July-1 Aug. 1949, L. R. Pickering. ALASKA. 4 pupae, Richardson Highway, Mp 193, 24 July 1948.

Acknowledgments

For his generous co-operation during the preparation of this paper it is a pleasure to express my thanks to Dr. Alan Stone of Washington, D.C. It is well known that, for a number of years, Dr. Stone has been engaged in a revision of the North American Simuliidae. When he learned of my intention to revise the Canadian species, Dr. Stone returned a considerable quantity of Canadian material that had already been sent to him, including the original material, from Churchill, of the two northern species described herein.

I am also indebted to Mr. James Kucyniak, Montreal Botanical Garden, Montreal, and to Mr. J. A. Calder, Division of Botany and Plant Pathology, Department of Agriculture, Ottawa, for identifying the water plants mentioned.

References

1. Twinn, C. R. The black flies of Eastern Canada. *Canadian J. Res.*, D, 14: 97-150. 1936.
2. Twinn, C. R., B. Hocking, Wm. C. McDuffie, and H. F. Cross. A preliminary account of the biting flies at Churchill, Manitoba. *Canadian J. Res.*, D, 26: 349-353. 1948.
3. Freeman, Paul. The external genitalia of male Simuliidae. *Ann. Trop. Med. Parasit.* 44: 146-152. 1950.

Meeting of the Entomological Society of Manitoba

A meeting of the Entomological Society of Manitoba was held on November 19th and 20th, at the University of Manitoba, Winnipeg. The scientific business was highlighted by a leading paper by Dr. C. A. Hodson, University of Minnesota, on the experimental approach to insect ecology. This was followed by discussions on specific aspects of insect ecology. Short papers were presented by Dr. J. W. Butcher, Forest Entomologist for the State of Minnesota, Dr. A. J. Thorsteinson, University of Manitoba, R. J. Heron, W. J. Turnock and J. A. Muldrew, of the Forest Insect Laboratory, Winnipeg, and T. V. Cole, of the Dominion Entomological Laboratory, Brandon. A banquet was held in the evening at the St. Regis Hotel. The guest speaker was Maurice Western, of the Winnipeg Free Press, who talked on recent developments in the Balkans. Mr. W. R. Allen presided.

R. J. LEJEUNE, *Secretary*

The *Illibalis* Group of the Genus *Palpita* Hübner (Lepidoptera: Pyralidae)¹

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For many years the true members of the *illibalis* group (usually placed in the wastebasket genus *Pyrausta*) have been listed as two or three species, under the names *gracilalis* Hulst, *illibalis* Hübner, and *arsaltealis* Walker. I was considerably surprised, therefore, to find several additional species standing, for the most part unrecognized, in North American collections. A further species, *baedulalis* Hulst, was compared by its author to *gracilalis*, and was placed by McDunnough (1939) between *gracilalis* and *illibalis*; I have seen the badly damaged type of *baedulalis* in the collection of Rutgers University, and am convinced that the species does not belong in the present group.

I have shown previously (Munroe, 1950)³ that the species of the *illibalis* group are not correctly placed in *Pyrausta*, but instead are closely related to the European *Palpita unionalis* and to its tropical congeners. I do not know of any morphological character that would make possible a clear separation of the *illibalis* group from the remainder of *Palpita*. Two generic names, however, have types that belong to the *illibalis* group: *Hapalia* Hübner, 1818, with *illibalis* Hübner as monotype; and *Sebuntia* Walker, 1863, with *guttulosa* Walker as monotype. For the present I put these in the synonymy of *Palpita*.

Palpita gracilalis (Hulst)

Figs. 1, 9, 15

Botis gracilalis Hulst, 1886: 151.

This well known species does not need an extended description. The ground colour is translucent white with nacreous reflections; the fore wing has the costa brown; the large reniform, the small orbicular, the broken basal band, and the diffuse postmedial band are all fuscous; there is a variable amount of fuscous dusting on the disc of the fore wing. The hind wing has an oblique, black, discocellular stripe, and a diffuse postmedial band, which is almost parallel to the margin.

Both fore and hind wings have black marginal dots and a gray line in the fringe. There is considerable variation in the amount of fuscous suffusion, but I have been unable to detect any geographic or seasonal correlation.

Length of fore wing 10-12 mm.

The male genitalia resemble those of the European *P. unionalis* Hübner (figured by Pierce and Metcalfe, 1938) in the broad valves, deep tegumen, narrow and truncate uncus, and well developed cremata. The external facies of the moth is also reminiscent of the more typical species of the genus, and I think it likely that *gracilalis* will be excluded from the *illibalis* group when a complete view of the genus can be taken.

Material examined: 74 specimens, including the type of *gracilalis* Hulst (in the Rutgers University collection), from the following localities.

California: Riverside; Loma Linda, San Bernardino Co.; San Diego; Argus Mts.; "Walters St."

Arizona: Phoenix; Babaquivera Mts.; Tucson; Tempe; Palmerlee.

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²Agricultural Research Officer.

³Mr. J. G. Franclemont has kindly drawn my attention to an error in the list of references in that paper. Under the heading "Hübner, J., 1808", I wrongly cited the "Erste Beiträge zur Sammlung exotischer Schmetterlinge". The work that I should have cited under this heading was the "Sammlung exotischer Schmetterlinge, Plate [209], [1808]", in which the generic name *Palpita* was validated.

Texas: Brownsville; Corpus Christi; San Antonio; New Braunfels; Kingsville; San Benito; Kerrville; Black Jack Springs; Blanco Co.

Two specimens in the United States National Museum are labelled as having been reared from *Ligustrum*.

***Palpita cincinnatalis*, new species**

Figs. 2, 16

Male. General colour dark gray. Labial palpus about as long as head, dark brownish gray above, whitish beneath, especially towards base. Eyes large. Frons with black and dark-brown scales mingled, and with a pale line next the eye; vertex with long, pale brown scales. Thorax above with mingled brownish gray and white scales; anterior margin of tegula dark. Fore wing brownish gray, costa irregularly darkened; reniform and orbicular confluent with costal shade, dark fuscous, the reniform indistinctly brown-centred; a general speckling with fuscous dots, these concentrated near the margins, smaller and less numerous on the disc. Marginal line fuscous, expanded and darkened between the veins to form black dots. Fringe light gray, with a darker line near the base. Hind wing clearer gray and with the scaling thinner than on fore wing. An indistinct, fuscous, oblique, discocellular line; some faint fuscous irrorations in the post-medial space; a fine, distinct, black, marginal line. Fringe similar to that of fore wing.

Length of fore wing: 10 mm.

Female unknown.

Male genitalia: the simplest in the group. Uncus and juxta slender; valve narrow, with a single short process directed dorsad from the ventral margin. Corema small, bearing a weak scent brush.

This species is distinguished from *P. arsaltealis* (Walker) by its smaller size, and by the short central process of the male valve. I supposed at first that it might represent a vernal form, absent in the north, of *arsaltealis*, but the examination of spring specimens of *arsaltealis* from Pennsylvania similar to those taken in summer in the same region, and the lack of variation in the shape of the ventral process of the valve among several slides of male genitalia of specimens of that species, convinced me that *P. cincinnatalis* was distinct. *P. cincinnatalis* is known to me only from the two specimens in the Canadian National Collection.

Holotype, male, Cincinnati, Ohio, Apr. 23, 1904 (Braun).

Paratype, male, Cincinnati, Ohio, May 2, 1903.

Type No. 5938, C.N.C.

***Palpita arsaltealis* (Walker)**

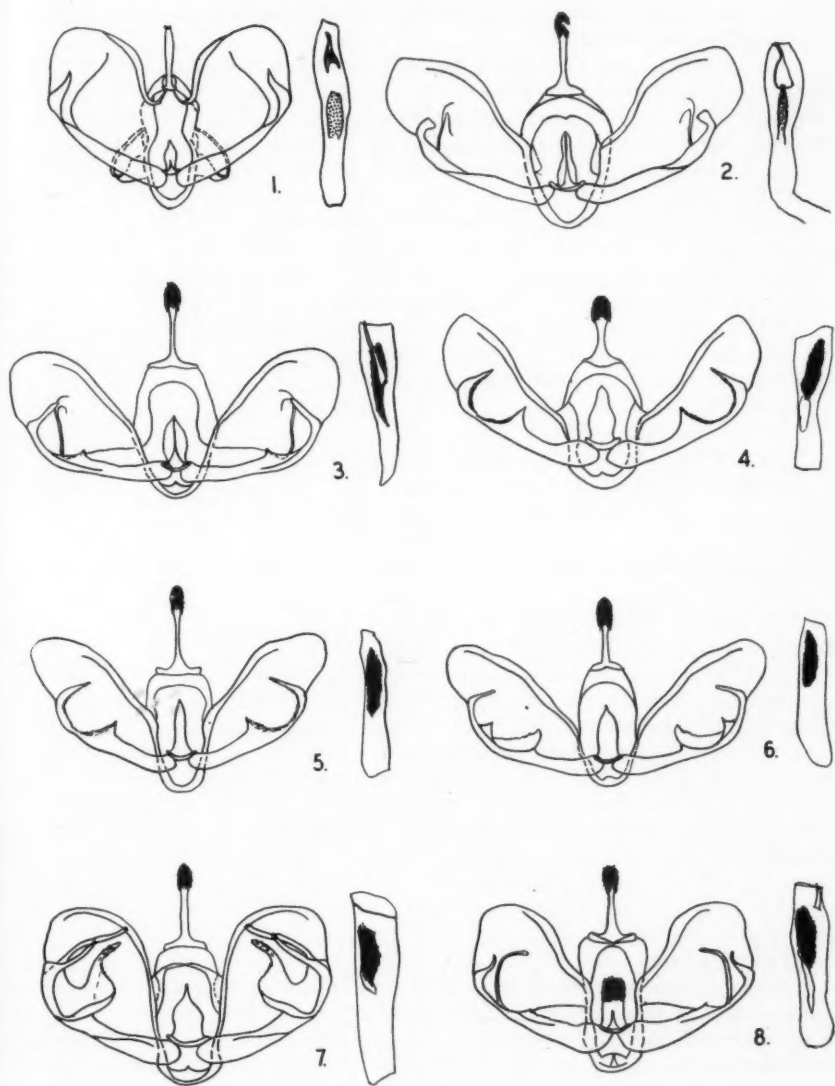
Figs. 3, 10, 17, 18

Botys arsaltealis Walker, 1859: 564.

This species closely resembles the preceding. The size is larger, the labial palpus shorter and more bushy, and the markings of the wings more diffuse. On the fore wing there is little trace of a brown tint in the gray ground colour, and the black dots are as numerous on the disc as at the margins, except in the area immediately before and beyond the reniform mark; on the hind wing, also, the dark dotting is very dense, and extends in as far as the discocellular dash.

Length of fore wing, 12 mm.

The male genitalia somewhat resemble those of *P. cincinnatalis*. The juxta is broader, especially in its dorsal half. The postero-ventral process of the valve is longer, and is acutely pointed instead of being blunt. There is also a more anterior ventral process, which is pointed and arises gradually from a triangular, spinulose, sparsely setose flange. The female genitalia have the seventh sternite



Explanation of Figures 1-8

1. *Palpita gracilis*. Male genitalia: deciduous cornuti not shown.
2. *Palpita cinnaminalis*. Male genitalia: deciduous cornuti not shown.
3. *Palpita arsaltealis*. Male genitalia.
4. *Palpita illibalis*. Male genitalia.
5. *Palpita euphaesalis*. Male genitalia.
6. *Palpita freemanalis*. Male genitalia.
7. *Palpita magniferalis*. Male genitalia.
8. *Palpita aenescentalis*. Male genitalia.

broad; the ostium is likewise broad, and its anterior margin bears a broad, triangular, heavily setose lobe.

This species is likely to be confused only with *P. cinnaminalis*. Both species differ from the other gray forms of the genus in having the ground colour of the hind wings as dark as that of the fore wings. *P. arsaltealis* is larger than *cinnaminalis* and has more extensive fuscous irroration on both fore and hind wings. *P. arsaltealis* is also more numerous and more widely distributed than *P. cinnaminalis*.

P. arsaltealis appears to be especially common in bogs and other wet places. Its life-history is unknown. In the Ottawa region moths fly in late June and July; in Pennsylvania, however, there is also an earlier generation, which flies in April; specimens have been taken at Hymers, Ont., in mid-June.

My identification of the species is based on a photograph of Walker's type.

Material examined: 17 specimens, from the following localities:—

Pennsylvania: Pittsburgh; Allegheny Co.

Connecticut: Putnam.

Minnesota: Alexandria.

New York: McLean Bogs Reserve, Tompkins Co.

Ontario: Hymers; Trenton; Ottawa.

***Palpita illibalis* Hübner**

Figs. 4, 11, 19

Palpita illibalis Hübner, 1808a: 5. Validated by appearance of Hübner [1809]-[1813].

Hapalia illibalis, Hübner, 1818: 19.

Pyrausta illibalis, Holland, 1903: 397; Pl. 47, Fig. 3.

Body and wings white, sometimes with a faintly brownish cast; membrane of wings with a strong purplish iridescence, which becomes conspicuous in worn specimens. Palpus short, dorsal half fulvous, ventral half white. Legs white; fore tibia with basal and distal fuscous bands. Abdomen with numerous, fulvous or fuscous scales dorsally. Fore and hind wings with fulvous or fuscous markings, disposed as follows: fore wing with prominent, solid reniform and orbicular, and with numerous speckles or irrorations, concentrated along the costa to form an almost solid shading; hind wing with distinct discocellular lunule, and with speckling in the distal half. Fore and hind wings alike with a fine, brown, marginal line, with black intervenular dots. Fringes white, each with an interrupted gray line near its base.

Length of fore wing, 12-13 mm.

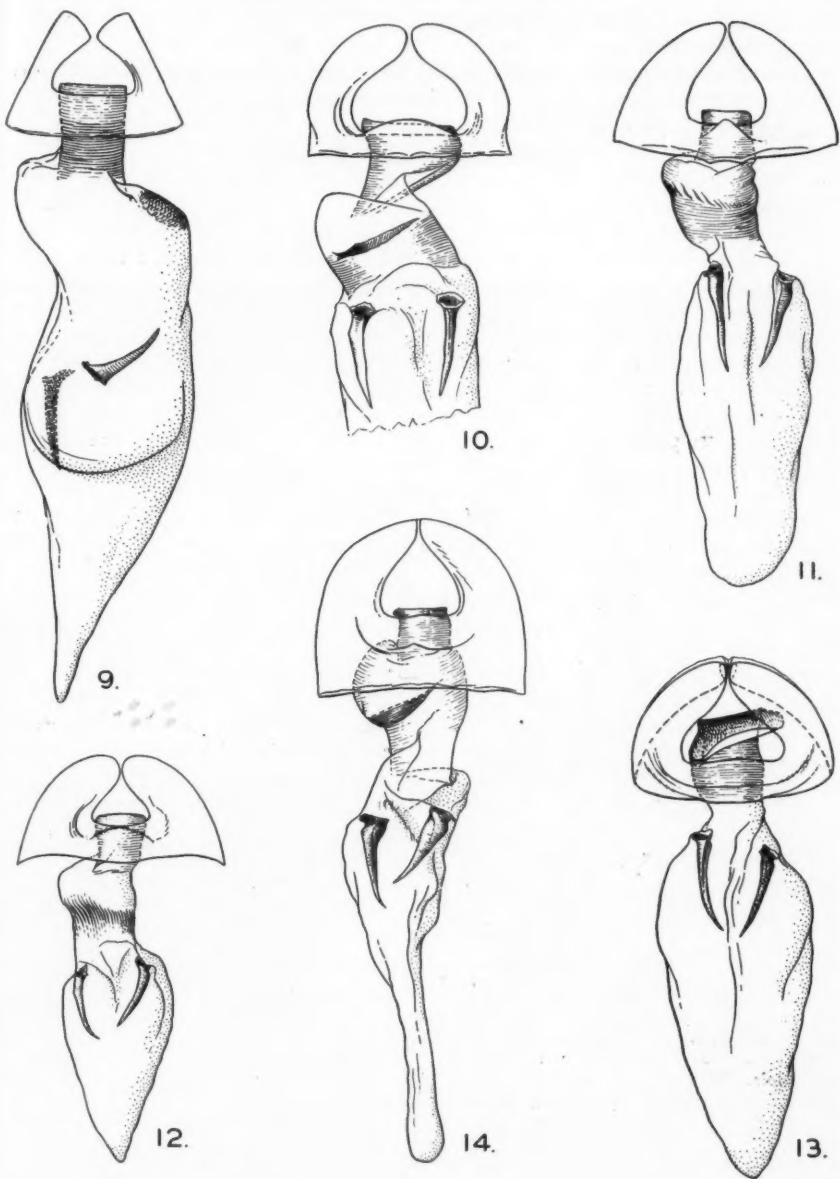
Male genitalia: resembling those of *P. arsaltealis*, but with both of the ventral processes of the valve larger and more sharply pointed, with the juxta large and stout, and with the fixed cornutus of the aedoeagus lacking. Female genitalia with the ostium narrower than in *arsaltealis*, the anterior lip with a narrow triangular projection; sclerotized collar at the entrance to the bursa longer and of smaller diameter.

I have seen only the poor figure in the "facsimile" Hübner. However, this shows a fulvous maculation, and this feature, in conjunction with the type locality of Georgia, leaves little doubt that the conventional identification is correct. Holland's coloured figure gives a good idea of the appearance of the moth. If the current proposal to suppress the "*Erste Zuträge*" is adopted, the name *illibalis* will date from 1818, and the author's name should be given in parentheses.

Material examined: 10 specimens, from the following localities:—

Florida: Lakeland; Dade City.

Alabama: Eufala.



Explanation of Figures 9-14

9. *Palpita gracilalis* ♀. Seventh sternite and bursa.
10. *Palpita arsaltealis* ♀. Seventh sternite and posterior part of bursa.
11. *Palpita illibalis* ♀. Seventh sternite and bursa.
12. *Palpita freemanalis* ♀. Seventh sternite and bursa.
13. *Palpita magniferalis* ♀. Seventh sternite and bursa.
14. *Palpita aenescentalis* ♀. Seventh sternite and bursa.

District of Columbia: Washington.

Arkansas: Hope.

I have glanced casually at some additional material in the Rutgers University Collection from Texas and from various southeastern localities.

The life-history is unknown.

Palpita euphaesalis (Walker)

Figs. 5, 20

Botys euphaesalis Walker, 1859: 1008.

Botys subjectalis [?] Lederer, 1863: 374; Pl. 10, Fig. 13.

In pattern this form appears to be indistinguishable from *P. illibalis*. The coloration is, however, different, the ground colour being grayish-brown, and the darker markings fuscous brown. It is not unlikely that *euphaesalis* will eventually prove to be a dimorphic form of *illibalis*. The specimens that I have examined of *illibalis* and *euphaesalis* seem to show minor genitalic differences, but with such small numbers these differences may well be individual. In particular the uncus and juxta of *euphaesalis* appear to be much more slender than the corresponding organs of *illibalis*. Variation in these proportions exists, however, in other species of the group, and it would accordingly be dangerous to place too much reliance on them in distinguishing species.

P. euphaesalis was described from a specimen without locality data. A photograph of the type shows clearly the distinctive characters of maculation and wing shape. The placement of *P. subjectalis* Lederer as a synonym is purely tentative. Lederer's figure is probably, like many others of his, inaccurate in detail. At least it does not agree with any of the forms now in front of me. Depending upon which characters one assumes to have been inaccurately portrayed, *subjectalis* could be referred to the synonymy of any one of four or five different species. Lederer's type is unfortunately not now available for study. Mr. Hahn W. Capps informs me that, according to the late Dr. Zerny, the type was a single male which was in the Vienna Museum. Dr. J. Klimesch, however, who asked Dr. Zerny's successor, Dr. Pittioni, to examine the type on my behalf, informs me that the specimen cannot now be found. It is not known whether it has been destroyed, or whether it was separated from the main collection for some special purpose prior to Dr. Zerny's sudden death, in which case it may easily have been simply mislaid. Lederer himself appears to have regarded his species as identical with *euphaesalis*, the type of which he had

Explanation of Figures 15-32

15. *Palpita gracilalis* ♂. Corpus Christi, Tex. Cornell Univ.
16. *Palpita cincinnatalis* ♂, holotype. Cincinnati, Ohio. C.N.C.
17. *Palpita arsaltealis* ♂. Ottawa, Ont. C.N.C.
18. *Palpita arsaltealis* ♂. Ottawa, Ont. C.N.C.
19. *Palpita illibalis* ♀. Raleigh, N.C. U.S.N.M.
20. *Palpita euphaesalis* ♂. Ozark, Ala. Cornell Univ.
21. *Palpita freemanalis* ♂, paratype. Brownsville, Tex., February. C.N.C.
22. *Palpita freemanalis* ♀, allotype. Brownsville, Tex., February. C.N.C.
23. *Palpita freemanalis* ♀, summer form. San Benito, Tex., August. U.S.N.M.
24. *Palpita freemanalis* ♀, summer form. San Benito, Tex., August. U.S.N.M.
25. *Palpita magniferalis* ♂. Big Indian Valley, Catskill Mts., N.Y. Am. Mus. Nat. Hist.
26. *Palpita magniferalis* ♀. Kazubazua, Que. C.N.C.
27. *Palpita magniferalis* ♀. Brome, Que. C.N.C.
28. *Palpita magniferalis* ♀. Wall, Pa. Carnegie Mus.
29. *Palpita magniferalis* ♂. Allegheny Co., Pa. Carnegie Mus.
30. *Palpita magniferalis* ♂, melanic aberration. Wall, Pa. Carnegie Mus.
31. *Palpita aenescentalis* ♂, paratype. Putnam Co., Ill. U.S.N.M.
32. *Palpita aenescentalis* ♀, allotype. Chelsea, Que. C.N.C.

probably seen. The name *subjectalis* was, however, proposed not exactly as a new name for *euphaesalis*, but rather as a name for a new species, on the principle that *euphaesalis* had not been recognizably described, and that the name had in consequence no status. If it is assumed that the wing shape is wrongly drawn, and that all the fuscous markings have been rendered in black, Lederer's figure may well be considered a representation of *euphaesalis*. Until the type of *subjectalis* is rediscovered this name may be considered a doubtful synonym of *euphaesalis*.



Material examined:—2 specimens, with the following data:—

Alabama: Camp Rucker, Ozark, March.

Maryland: Plummer's Island, June.

Also a third specimen from the Fernald Collection, without locality data.

Some specimens from Florida in the Rutgers University collection appeared to belong to this species, but I did not compare them directly with authentically determined material.

***Palpita freemanalis*, new species**

Figs. 6, 12, 21-24

This species has two rather sharply distinct forms. In one the ground colour is gray and the dark markings fuscous; in the other the ground colour is white and the dark markings bright orange. Intermediate specimens sometimes occur in which the ground colour is white but the markings are brown or fuscous. The gray form appears to predominate in winter, the white one in summer. I have selected the gray form as the typical one.

Typical (winter) form. Labial palpus short, fuscous above, light gray beneath; frons fuscous in the middle, light gray at the sides; antennae and vertex gray. Thorax and abdomen above gray with black patches; white beneath. Legs pale gray, fore tibia with black basal and distal rings, all tarsi ringed with fuscous. Apex of fore wing rather blunt. Fore wing above with ground colour silvery gray, heavily irrorated with black, except in and beyond cell, where the irrorations are sparse. An oblique brown shade beyond end of cell. Reniform and orbicular black, an irregular fuscous patch behind and contiguous with reniform. Hind wing pale gray, distal third heavily speckled with fuscous; discocellular line narrow, light fuscous. Both fore and hind wings with narrow, fuscous, marginal line; fringes pale gray, each with a dark gray, checkered, median line. Under side pale gray, with markings of upper side faintly indicated in dark gray.

Length of fore wing, 9-10 mm.

The summer form is similar in markings, but the pale areas are creamy white and the dark markings are orange or brown. There are no obvious sexual differences in maculation.

Male genitalia: resembling those of *P. arsaltealis*, but with the proximal process of the valve larger and scoop-shaped, the distal process longer, and a third, thorn-like process intercalated between the other two. Female genitalia closely similar to those of *illibalis*, but without a definite conical process on the anterior margin of the ostium, and with the ostium itself opening farther back on the seventh sternite.

Holotype, male; allotype, female; 25 paratypes: Brownsville, Texas; February, 1937; T. N. Freeman; type No. 5839 in the Canadian National Collection.

The following additional paratypes in the United States National Museum: one each from Plano and Victoria, Texas; one "Texas, Belfrage"; and one from Vicksburg, Miss.

Specimens from the following localities belong to the summer form, and are accordingly not included in the type series: San Benito, Texas; Grant, Oklahoma; Alexandria, La.

***Palpita magniferalis* (Walker)**

Figs. 7, 13, 25-30

Botys magniferalis Walker, 1861: 41.

Scoparia fascialis Walker, 1862: 127.

Sebuntia guttulosa Walker, 1863: 78.

Labial palpus a little longer than eye, fuscous, white below; frons dark gray with a white lateral stripe adjacent to eye; antenna dark gray; vertex pale gray. Thorax and abdomen above pale gray, irregularly marked with fuscous; below white, with fuscous markings laterally and posteriorly on abdomen. Legs grayish white, all tibiae and tarsi banded with fuscous. Fore wing above silvery gray, with a brown patch of variable size beyond the cell. A basal dash and the reniform and orbicular spots all black, reniform narrowly crescentic, the hollow of the crescent often filled with fuscous. Heavy fuscous and black speckling and irroration over most of the fore wing, often coalescing to form irregular fuscous patches; reduced in the cell and in a roughly circular patch beyond. Hind wing pale gray, translucent, with a weak, fuscous discocellular line, and with light fuscous speckling, which frequently extends inward almost to the base of the wing. Fore and hind wings with a black marginal line and a dark line through the middle of the fringe. On the fore wing black intervenular dots on the fringe line extend inward to meet similar dots on the marginal line, giving a checkered appearance to the margin. Under side dull gray, with dark markings reduced.

Females have on the average more restricted dark markings than do the males.

Length of fore wing, 12-13 mm.

Male genitalia: Uncus long and slender; juxta broad and thorn-shaped. Valve broad, rounded at tip. Proximal process of valve broad, flange-like, with an oblique carina, a serrate dorsal margin, and a long, bent, conical, spinulose, postero-dorsal projection; middle and distal processes crossed scissors-wise, each twisted and pointed at tip.

Female genitalia: Ostium broad, anterior lip without a triangular projection; lobes of seventh sternite double, the specialized, bilobed portion overlapping the remainder.

P. magniferalis resembles the winter form of *P. freemanalis* most closely in external appearance, but differs in its larger size. The genitalia of both sexes are distinctive.

This species appears to be the most common and widely distributed of the group. In the north it flies in late May and in June, between the flight of *arsaltealis* and that of the following species. It is found in all types of habitat in which the food plant occurs. The moths rest in the day-time on tree trunks, holding the wings partly spread and the tip of the abdomen recurved over the thorax.

The larva has been taken by the Forest Insect Survey, Division of Forest Biology, Canada Department of Agriculture, on green, black, and white ash.

The type of *magniferalis*, from the D'Urban Collection, is now in the Canadian National Collection. Photographs of the type of *fascialis* (in the collection of Oxford University) and of that of *guttulosa* (in the British Museum) show that these names are synonyms of *magniferalis*.

Material examined: 223 specimens, from the following localities:—

Arizona: Prescott.

Louisiana: Camp Claibourne.

Mississippi: Greenville.

Tennessee: Monteagle.

Florida: no more precise locality.

Georgia: Atlanta.

North Carolina: Black Mts.

West Virginia: Jeff. Co.

Maryland: Plummers Island.

District of Columbia: Washington.

Delaware: New Castle Co.

Nebraska: southeastern portion.

Michigan: Mackinaw City.

Illinois: Decatur; Putnam Co.; Lacon.

Indiana: Winona Lake.

Ohio: no definite locality.

Pennsylvania: Finleyville; Oak Station; Shawville; Pittsburgh; Guyasuta Run; Swissvale; Sharpsburg; Wall; Allegheny Co.

New Jersey: Pine View, Monmouth Co.; Mendham; Englewood.

New York: New York; Big Indian Valley, Catskill Mts.; Ithaca; Albany.

Vermont: Manchester.

New Hampshire: Franconia; North Conway.

Maine: Nicasus Lake; Orono; Enfield; Augusta; Rangeley.

Ontario: Ottawa; Kearney; Port Colborne; Thunder Bay; Orillia; Nogie's Creek; Ganthley; Aylmer; Owen Sound; Tehkummah; Oakville; Lindsay; Barrie; Welland; Kitchener.

Quebec: Burbridge; Norway Bay; Kazubazua; Meach Lake; Aylmer; Brome; Ste. Anne de Bellevue.

Nova Scotia: Annapolis; Waverly.

***Palpita aenescentalis*, new species**

Figs. 8, 14, 31, 32

Labial palpus about twice the length of the eye, brown above, pale below. Frons and vertex brown. Thorax brown above. Abdomen above fuscous, with pale gray scales widely distributed on first tergite, on the rest restricted to the lateral and posterior margins; and tuft brown. Thorax and abdomen beneath grayish white. Legs with anterior surfaces brown, darker distally, posterior surfaces grayish white.

Fore wing longer, narrower, and with apex more acute, than in any other species of the group except *gracilalis*. Ground colour above gray, with pronounced brassy reflections; an indefinite brown patch extending diagonally across the wing beyond and below the cell. Reniform, orbicular, and costa shaded with brown or fuscous. Black speckling dense, though sometimes fine, becoming sparse in and just beyond the cell. A series of black marginal dashes at the ends of the veins; fringe brown, with a darker sub-basal line. Hind wing translucent grayish white, with a faint discocellular line, and a variable amount of black speckling. Marginal line black, fringe gray with a brown sub-basal line. Under surface grayish white, with the markings of the upper side faintly repeated.

Length of fore wing, 12-14 mm.

Male genitalia with uncus comparatively thick, decurved at the tip. Valve moderately broad, base of sacculus subserate dorsally; distally the sacculus bears two processes, crossed scissor-wise, one about one-third, the other about two-thirds, as long as the depth of the valve. The juxta is unique in the group in being dorsally truncate and spinulose. The aedeagus has a sclerotized strap in the wall and contains the usual deciduous cornuti and a small fixed cornutus. Female genitalia with ostium narrow and relatively far back; surrounding specialized area of seventh sternite also small. Ductus bursae expanded just before ostium.

This species can be distinguished from others of the group by the rather sharply pointed fore wing, which almost always has strong brassy reflections on the upper surface. The other species have a purplish or bluish iridescence or

none. *P. aenescentalis* flies in April and early May, apparently throughout its range.

Holotype, male: Ottawa, Ont.; Apr. 29, 1906; C. H. Young; in the Canadian National Collection.

Allotype, female: Chelsea, Que.; Apr. 30, 1936; W. J. Brown; in the Canadian National Collection.

Paratypes: In the Canadian National Collection: 5 males, Ottawa, Ont.; 1 male, Perkins Mills, Que.; 2 males, Chelsea, Que.; 2 males, Old Chelsea, Que.; 5 males, Kirks Ferry, Que.; 1 male, 2 females, Putnam Co., Ill.

Type No. 5940, C.N.C.

Additional paratypes are in other collections, as follows:—

In the American Museum of Natural History: 2 males, Wawayanda Swamp, N.J.; 1 male, Scranton, Pa.

In the Cornell University Collection: 4 males, 2 females, Sardinia, N.Y.

In the United States National Museum: 1 male, Rideau Park [? Ottawa, Ont.]; 1 male, Ottawa, Ont.; 5 males, 2 females, New Brighton, Pa.; 1 male, Putnam Co., Ill.; 1 male, Alpine, Tex.

In the Carnegie Museum, Pittsburgh: 1 male, Slippery R. Cr., Lawrence Co., Pa.; 4 males, Shawville, Pa.; 1 female, New Brighton, Pa.; 1 male "W. Va."

In the collection of Murray O. Glenn, Magnolia, Ill.: 5 males, 1 female, Putnam Co., Ill.

In the writer's collection: 1 male, McLean Bog Reserve, Tompkins Co., N.Y.

Keys to the Species Discussed

A.—Based on external characters

1. Ground colour white 2
- Ground colour gray 4
2. Fore wing with costa brown, other markings contrastingly fuscous; hind wing with a regular, diffuse, fuscous submarginal band; wings without definite speckling, though often with diffuse fuscous dusting *gracilalis*
- Fore wing with costal and other dark markings of the same colour; hind wing without a regular submarginal band; fore and hind wings irregularly speckled with fuscous, brown, or orange 3
3. Length of fore wing about 8 mm.; wings heavily speckled with diffuse orange or brown dots (summer forms) *freemanalis*
- Length of fore wing at least 10 mm.; wings lightly speckled with brown or fuscous, chiefly in the distal half *illibalis*
4. Fore wing dark, silky gray, with strong brownish tints at least beyond and behind cell; apex subacute 5
- Fore wing dull or pale, mat gray, with brownish tints at most in a patch in the post-medial space; reflections, if present, pearly; apex usually rounded 6
5. Fore wing usually with strong brassy reflection; usually two and one half to three times as long as wide; heavily speckled with fuscous *aenescentalis*
- Fore wing never with a brassy, sometimes with a pearly, reflection; about twice as long as wide; with rather sparse fuscous speckling *euphaesalis*
6. Fore wing dark gray, without a definite brownish postmedial patch, reniform and orbicular usually only weakly contrasting; hind wing little paler than fore wing 7
- Fore wing almost always with extensive pale gray scaling; reniform and orbicular contrastingly fuscous, often a large fuscous patch behind the reniform; often a brown postmedial patch 8
7. Length of fore wing about 10 mm.; dark speckling moderately dense *cincinnatalis*
- Length of fore wing over 11 mm.; dark speckling very dense *arsaltealis*
8. Length of fore wing about 10 mm. *freemanalis*
- Length of fore wing over 11 mm. *magniferalis*

B.—Based on male genitalia

1. Juxta dorsally truncate and spinulose *aenescentalis*
- Juxta dorsally pointed and without spinules 2

2. Aedoeagus with a thorn-like fixed cornutus in addition to the barbed deciduous cornuti 3
Aedoeagus with a bundle of barbed deciduous cornuti, sometimes on a sclerotized base,
but without a fixed cornutus 5
3. Uncus weak, not expanded or conspicuously spinulose at tip *gracilalis*
Uncus well developed, with tip expanded and spinulose 4
4. Fixed cornutus broad and short; process of sacculus truncate, its length about one-fourth
of the depth of the valve *cinnaminalis*
Fixed cornutus long and slender; process of sacculus slender at tip, its length about one-
half of the depth of the valve *arsaltealis*
5. Sacculus with two moderately long processes, the basal one broadly triangular, the distal
one slender and acutely pointed *illibalis*; *euphaesalis*
Sacculus with three processes 6
6. Processes of sacculus all long, reaching or nearly reaching costa of valve *magniferalis*
Processes of sacculus not nearly reaching costa of valve; the middle one very short *freemanalis*

C.—Based on female genitalia

1. Posterior lobes of seventh sternite broadened and obliquely truncate behind *gracilalis*
Posterior lobes of seventh sternite incurved and rounded behind 2
2. Lateral and posterior margins of seventh sternite folded under, so that in ventral aspect
a triple layer of chitin is seen over more than half the width of the posterior lobes...
magniferalis
Lateral and posterior margins of seventh sternite at most very weakly folded under at
the extreme margin of each posterior lobe 3
3. Ostium occupying at least half total width of seventh sternite *arsaltealis*
Ostium occupying much less than half total width of seventh sternite 4
4. Anterior limit of ostium three times as far from posterior as from anterior margin of
seventh sternite; a distinct subconical prominence extending from the anterior lip into
the ostium *illibalis*; *euphaesalis*
Anterior limit of ostium at most twice as far from posterior as from anterior margin of
seventh sternite; anterior lip of ostium with at most a low, rounded prominence 5
5. Seventh sternite about as wide as long; anterior limit of ostium equidistant from anterior
and posterior margins of seventh sternite *aenescentalis*
Seventh sternite about twice as wide as long; anterior limit of ostium nearly twice as far
from posterior as from anterior margin of seventh sternite *freemanalis*

Acknowledgments

I wish most sincerely to thank the colleagues who so generously helped me in the study of this group. Dr. A. E. Brower, of Augusta, Me.; Mr. Hahn W. Capps, of the United States National Museum, Washington, D.C.; Dr. Wm. T. M. Forbes, of Cornell University, Ithaca, N.Y.; Mr. Murray O. Glenn, of Magnolia, Ill.; Prof. A. B. Klots, of the City College of New York, New York, N.Y., and the American Museum of Natural History, New York, N.Y.; the late Dr. Walter R. Sweadner, of the Carnegie Museum, Pittsburgh, Pa.; and Mr. Edward G. Voss, of Ann Arbor, Mich., all loaned specimens from their private collections or from the institutional collections under their care. Mr. W. H. T. Tams, of the British Museum (Natural History), London, England, with his unfailing kindness, supplied photographs of the Walker types in the British Museum and the Oxford University Collections; Dr. A. Klimesch, of Linz, Austria, investigated Lederer's type of *Botys subjectalis*. Mr. H. Raizenne, Forest Insect Investigations, Division of Forest Biology, Canada Department of Agriculture, Ottawa, supplied information on the biology of *Palpita magniferalis*.

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Facets of Insect Surveys*

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I believe that in the main insect surveys have been initiated each because of some definite need. In the case of surveys of pest species, such as the chinch bug, corn borer, or budworms, the need has been the necessity of obtaining accurate knowledge of population densities and areas of infestation, this to serve as a basis for predicting economic losses or extent of needed control operations.

In most instances general faunistic surveys have had a more roundabout motivation. This kind of a survey usually starts out as an identification service, its aim to tell whether or not suspected insects are injurious or beneficial, and if injurious, how much so, and what is known regarding the control of the species. Here again the desire to predict is uppermost in our mind, as with the case of pest surveys. Difficulties always arise in distinguishing injurious from closely related non-injurious forms, or in being sure how many kinds of insects are involved in one group or another. In attempting to solve these problems we gradually arrive at the point where we want to know how many kinds of all insects there are in a region, and how to tell them apart.

When we reach this stage in our endeavors, we have arrived near the concept of a general faunistic survey, and it is this kind of survey that I want to discuss.

For insects such a survey is a tremendous project. We have estimated that in Illinois there are about 20,000 species of insects. Each species has at least three or four distinctive stages or forms, such as eggs, larvae, or adults, so that the Illinois fauna alone presents a minimum problem of 60-80,000 identification units. Two reports, treating the plant bugs and caddisflies of that state, include 439 species and are together 1½ in. thick. At this rate it will take a shelf of reports 7½ feet long to treat the Illinois fauna alone. In Canada there are probably 50,000 species and in North America well over 100,000. This seems like an overwhelming task, but we can take initial encouragement from the fact that already much has been done. For many groups treatises are available which

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are sufficiently complete that either they fill our present identification needs or give us an easy avenue of approach if we want to rework a particular group. As examples we can mention adult *Macrolepidoptera*, *Mecoptera*, and families or genera scattered throughout the orders of insects.

In order to handle this great number of insects it has been necessary for each taxonomist to work on only a small portion of the fauna, frequently a family or small order. This type of specialization is especially necessary for a successful insect survey, because of the tremendous amount of material which must be handled and studied in making a survey of even a small group.

While not necessary in theory, nevertheless in actual practice there are three closely interwoven elements in the insect survey orbit: identification service, research collections, and the survey itself.

Identification Service

Identification service is a function that becomes more difficult every year. In the first place we are finding that there are more and more species of insects which differ not in conspicuous external characters but in the minute characters of genitalia or other parts which it requires considerable pains to see properly. Now some folks seem to have the idea that taxonomists like to use these difficult characters just because they are difficult, but such is not the case. We use them because we have found that in so many cases they are the only thoroughly reliable criteria we have for exact identification. The second great troublesome problem concerns larvae, and it is twofold. There is the initial problem of rearing or associating the larval stage with the adult stage, so that we know which goes with which. Next there is the problem of finding diagnostic characters by which to tell larvae of one species from those of another. Our knowledge in this field is only in its swaddling clothes, for while we have available material of many economic forms, we lack material of great numbers of native species which might readily be confused with them. I might mention as examples such groups as cutworms, leaf-rollers, and weevil larvae, in which diagnostic characters for the larvae between economic and non-economic species are poorly understood. This type of differentiation has a real and monetary value, because as much money is saved by knowing when not to attempt control because the suspected insects will do little damage, as is often gained by actual control applications for a known bad pest.

The number of larvae which are submitted for identification seems to be ever on the increase and I would like to emphasize the urgent need for more rearing work and study on this problem. I would like especially to appeal to amateur enthusiasts and applied workers to make special efforts to cooperate with identification groups in saving good associated material for them whenever possible.

Research Collections

Problems of the research collection arise from the need to preserve material in the fashion in which it can best be studied, balanced against the time factors of what must be done and how much help there is to do it. Our ideas of preservation are more plastic now than they were several decades ago. We know that in order to identify certain groups we need both pinned material and material preserved in fluid. We are still searching for the perfect mounting medium for slide preparations. For gross structures, like sawfly saws, stained mounts in balsam or damar are quite satisfactory, but for thrips, chiggers and many other small organisms, glycerine base or other media are necessary to get required refraction or to utilize phase microscopy. Indeed, there are grounds for

thinking that in some of these groups we may need an entirely new collection every few decades in order to keep apace with the use of new characters requiring new methods of preparation and study.

It will not be surprising if we gradually adopt different methods of preparation for many groups, especially with larvae and soft-bodied insects. This has been the case for a long time with other invertebrate groups such as the parasitic phyla, and with the unicellular organisms. A collector's outfit for these groups contains a weird variety of preserving solutions using chloral hydrate or formalin, or picric acid, or a wide range of other chemicals. Right now most of us entomologists are content with simply a bottle of alcohol. But I believe that the entomologists have been confronted with the task of collecting and preserving such an overwhelming number of specimens that we have of necessity clung to a few simple methods which can be used speedily and without the loss of time occasioned by divers and more painstaking methods.

Faunistic Surveys

The problems of identification and research collections are problems of faunistic surveys also, because surveys are based on identified collections. Surveys, however, have their own peculiar characteristics and problems.

Here we must raise a question crucial to this point. Where does a collection end and a survey begin? What is the difference between them? It seems to me that the difference is chiefly one of viewpoint. With the collection, we consider the one specimen or collection before us with the view of identifying it or placing it with the category or species to which it belongs. In a survey we are thinking of these same individuals as samples of the huge populations which are the species in nature. In this survey viewpoint we think of these species not as so many inert specimens pinned out over the landscape, but as living entities with dynamic characteristics about which we want to get information. In a word, if you add life to a collection it turns into a survey.

In a faunistic survey, dealing with collected material and without benefit of experiment, how can you add life to this collection? The first step must be the realization of what species mean. From an identification standpoint, species are distinguished one from another by various morphological or color characters, often minute and frequently inconspicuous. But these characters are by no means the only differences between the species. The morphological criteria we see are correlated with physiological characteristics which are the real basis of the ecological differences between the species as they exist in nature.

There is, for example, a certain small complex of leafhoppers in the genus *Erythroneura* which resemble each other closely but which can be differentiated by means of slight but constant differences in structures of the male genitalia. That is all we can see on the dead specimen. Yet in nature each occupies a different place. One species breeds only on maple, another on *Crataegus*, and two others on white oak. These host differences must certainly have their basis in some sort of physiological difference between the species, for it is difficult to understand how the morphological differences in genitalia would have any direct connection with host requirements. There must be involved differences between each species concerning either specific hosts, or behavior differences regarding host selection, or some combination of these and/or other physiological attributes.

Another interesting example concerns a small group of winter stoneflies which occur in Illinois. As with the leafhoppers, these species are differentiated almost entirely on the basis of minute differences in genitalia. Two species emerge as adults chiefly in late autumn, two others emerge chiefly in February and

March, and a fifth emerges fairly continuously over the entire period. The three types of seasonal adjustment shown by these insects must be dependent, not on the slight identification characters known in the genitalia, but on physiological differences relating to enzyme-temperature relations or to oxygen requirements, or some other coordinating relationship between the species and its environment.

To look at these ideas from another direction, we can say that species are endowed with their own peculiar physiological properties which are expressed as the ecological characteristics of the various species.

With proper planning of observations and collecting, a faunistic survey will bring to light information about the ecological characteristics of the group under consideration. Initial plans can be made to investigate the ecological characteristics which are well known and basic, such as the following:

1. Range. Its range is one of the fundamental ecological characters of a species, yet we have only meagre information regarding the full range of hundreds of thousands of insect species. The range indicates the ecological tolerance of the species, and it is interesting to know whether it is large or small, and what are its geographic limits. In the case of species with large ranges, such as with holarctic species, only a part of the range will be in the surveyed area, but even in these cases information can be obtained on the limits of range in one direction or another, or evidence brought out on discontinuities of range. These data are important because entirely different environmental factors operate to restrict the range of a species on different parts of its periphery. For example, temperature tolerance may determine the north and south limits of a species' range, and humidity its east or west limits.

2. Seasonal cycle. In areas with a definite alternation of winter and summer, we know that species differ in the time of year when each stage appears, in the number of generations which are produced each year, and in the manner in which they pass the winter or other unfavorable periods of the year.

3. Food. While we know well the food habits of some insect species, we have only scattered information on those of others. We need to know the total range of an insect's food, if broad, how broad, if narrow, how narrow. We often say "This species feeds on willow". How often do we know how many species of willow, and if there is a different selection of food species in different parts of the range?

These three items are all basic living properties of species which can be ascertained by planned collecting over the area being surveyed. Collecting must be such that it will tell us where a species does not occur as well as where it does occur. The basis of analysis is always the organization of data by species after the material has been accurately identified.

Now it is our thought that the specialist working in a particular group should take an active, and preferably the principal role in actually collecting the material in his group. The basis for this thought is the following very simple reason. We can deduce conclusions only on those points for which we have data. The locality label that reads "Chicago, Illinois, June 15, 1949" gives information on range and seasonal distribution, but nothing else. If it also reads "breeding on *Ulmus americana*" we have information on its food. But if the specialist is in the field he will be able to make identifications when the material is actually bagged and notice other correlations concerning microhabitat or ecological niche which need to be made on the spot. Of the various species of *Erythroneura* leafhoppers feeding on *Crataegus*, for instance, we found that only one occurred on isolated trees standing in full sunlight, that a group of two occurred on trees with partial shade, and still a third group only on trees in deep shade. We mentioned a group

of winter stoneflies a few moments ago. It was noticed in collecting them that certain species occurred only in small, rapid streams, another pair of species only in small slow streams, and that a third was found only in fairly large streams and small rivers.

Habitat differences such as these help to indicate what niche in the community is occupied by each species. In some species the niche is small and closely circumscribed, in others the niche is large and more general. We can never know these features until we find out by observation what kind of information we need to record, and then gather careful and orderly data on these facets of the insect's life.

An insect survey built with these thoughts in mind can gather a great deal of information about the living relations between various species and their environment. We can find out where they occur, when they are active, what they eat, what exact situation they prefer within their range, and many other things. We will find that no two species are exactly alike in these properties, and that we can detect and estimate the ecological differences correlated with the morphological characters used to identify the species.

Reports embodying these ecological findings with well illustrated diagnoses for the accurate identification of the species will record the information in a usable form very welcome to the entire entomological fraternity.

It has been my belief that a sound scientific problem should bring to light at least as many questions as answers. There is not a doubt but that an insect survey raises enough basic questions concerning the relationships between the insect species and their environment to keep all the insect physiologists in this country busy for the rest of their lives.

Notes on Leconte's Sawfly

By A. S. WEST

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Leconte's sawfly or the red-headed pine sawfly (*Neodiprion lecontei* Fitch) is a common insect attacking pines in Ontario. Plantations of red pine are almost invariably attacked from the time the trees have reached two to four feet in height. Periodically epidemic populations cause significant damage. The life history and habits of the species have been described by Middleton (2) who states that this insect attacks practically all species of pine as well as larch. Schaffner (3) also indicates that the larvae feed on a wide variety of pine and occasionally on other conifers. Red pine (*Pinus resinosa* Ait.) is undoubtedly the usual host, although in Ontario jack pine (*Pinus banksiana* Lamb.) is sometimes attacked. In 1946 evidence was secured to show that jack pine needles may be selected for oviposition even in an area where red pine foliage is plentiful. (Figure 1)¹.

Atwood (Atwood and Peck, 1) states that white pine foliage may be eaten by larvae that have migrated to that host because of starvation but that apparently white pine is not selected for oviposition.

During the summer of 1946 the writer observed a heavy infestation of *N. lecontei* in a mixed coniferous plantation consisting of white pine (*Pinus strobus* L.) and red pine near Varty Lake, Lennox and Addington County, Ontario. Although it was too late in the summer to find egg-scars, the appearance and

¹The writer is indebted to Dr. A. Wilkes, Dominion Parasite Laboratory, Belleville, Ontario, for the taking of photographs and for assistance in observations.



FIG. 1. Egg-scars of *N. lecontei* on jack pine near Belleville, Ont., July 1946.

position of infested trees with respect to one another suggested that deposition of eggs may have occurred on both species of pine.

The plantation was established as a demonstration plot in 1937 on an area of approximately eight acres formerly occupied by a sugar bush. A mixture of equal numbers of white and red pine was planted with apparently good survival. Since the date of planting coppice growth has been rapid in parts of the area so that many trees are somewhat stunted. In other parts of the area the pines still overtop the brush.

When the area was first visited in August, 1946, larvae were for the most part maturing. The infestation was heavy and distributed generally throughout the plantation. Many dead red pines and several dead white pines which had apparently succumbed to attack in previous years were observed. Earlier infestation was indicated by the presence of old frass. Numerous trees of both species had been completely stripped during the 1946 season.



FIG. 2. The effects of *N. lecontei* larvae feeding on white pine.

Figure 2 shows two views of partially defoliated white pines. In the background small red pines show little evidence of defoliation.

Numerous instances were observed where a white pine was heavily infested while the nearest red pines were uninfested or supported but a few larvae. In a few cases white pines which were heavily infested were found in secluded locations, more or less isolated by dense brush growth. Thus, it appeared that the infestation of white pine might be primarily due to the selection of the trees for oviposition rather than to the migration of larvae from red pine.

The plot was examined in detail in 1947 and 1948 during the period of *lecontei* development. In both years the infestation was extremely light and confined entirely to red pine. The reduction from a peak population in 1946 may have resulted in part from the collection of large numbers of larvae for parasite host material. However, elsewhere in the province a general reduction in *N. lecontei* populations occurred during the same period.

Although these observations do not refute the opinion expressed by Atwood (loc. cit.) that *N. lecontei* eggs are not laid on white pine, the writer feels that further observations are warranted.

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A Slide Heater for Clearing Minute Insect Specimens¹

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The use of potassium hydroxide solutions for clearing minute insect specimens, or portions of large ones, is a well-known and widely used procedure. Extreme care, however, is necessary to provide rapidly the exact degree of transparency in the subject. To provide for these requirements an economical heater was designed to warm a micro-culture slide bearing a few drops of clearing solution. The specimen is immersed in the cold solution on the slide, and the slide is then placed on the heater. The requisite amount of current is supplied to the heating element and clearing of the specimen to the exact degree desired can be obtained in a short time while the process is observed through a binocular dissecting microscope.

The heater (Figs. 1, 2) is made up in the following manner: a small lidless box measuring two inches by one inch by one-half inch (a) is made of 26-gauge sheet copper. The sides are one-sixteenth of an inch higher than the ends to prevent the glass slide slipping sideways. A narrow copper strip (Fig. 1, k), one-eighth of an inch wide, is soldered across the centre of the box at the same height as the ends. This strip supports the slide and adds rigidity to the box. The heating element (c) is made from a 13.5-inch length of 27-gauge chromel wire. One-half inch of the wire is wound on the binding post at each end of

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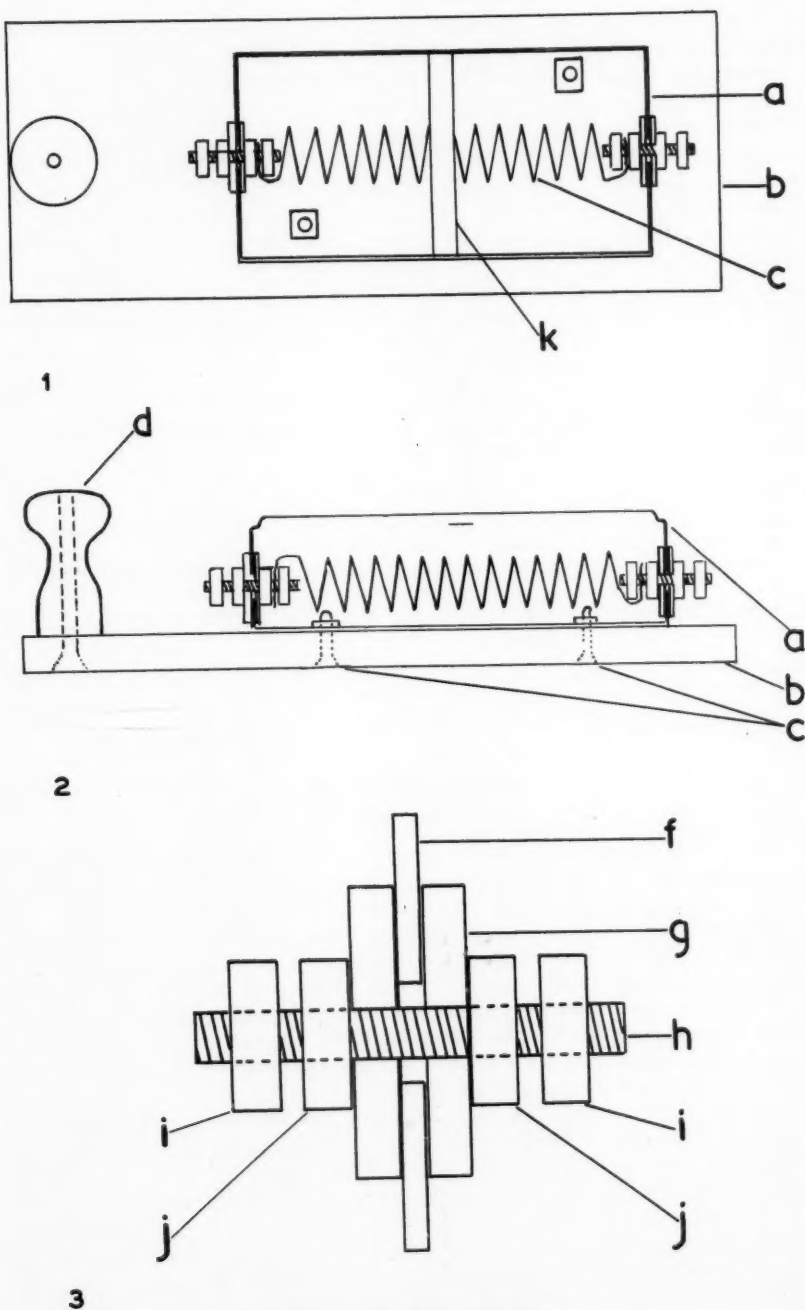


FIG. 1. Plan view of heater.

FIG. 2. Side view of heater.

FIG. 3. Details of binding post.

the box, and the remainder is coiled to form an element one and five-eighths inches in length and three-eighths of an inch in diameter. With a current of not more than seven volts obtained through a 75-watt laboratory transformer, heat is produced but the element does not glow.

The binding posts (Fig. 3) are threaded brass rods (h) one-half of an inch in length by one-sixteenth of an inch in diameter. The holes through which the binding posts pass are drilled larger than the diameter of the rods. Discs of sheet mica (g) are used to insulate the binding posts from the end walls of the box. Nuts (j) hold the assemblies of the binding posts in place. The binding posts must be kept in the centre of the hole when the nuts of each assembly are being tightened. This is accomplished by assembling the inside nut and the mica disc on the post before inserting the post in the end of the box. Alternating current through a laboratory transformer is supplied by a double conductor flexible cord similar to that used for hearing aids. This cord is attached to the binding posts under the outside nuts (i).

An asbestos base (Figs. 1 and 2, b), four by one and one-half inches by one-sixteenth of an inch, is bolted to the copper box. This base provides the necessary weight for stability and allows for handling the box when hot. A handle (Fig. 2, d) is attached at one end of the base for manipulation on the microscope stage.

Book Reviews

Nordens Eupithecier: By Knud Juul. Pp. 147; with six coloured and seven black-and-white plates and 60 maps and illustrations in the text; text in Danish with summaries in English. Aarhus; Gravers Andersens Forlag: \$4.75.

This small but attractive book is designed as a collectors' and biologists' manual of the species of *Eupithecia*, *Gymnoscelis*, and *Chloroclystis* in the Fennoscandian fauna. Although the format is compact, the book contains a large quantity of conveniently arranged information. The main text is in Danish, but all significant parts are very fully summarized in English, so that the reader does not need a knowledge of the Danish language.

Some brief introductory material is followed by a condensed description of each of the 56 species treated. These descriptions are in a standard form, dealing with adult characters, including those of the genitalia, then with characters of the early stages, with distribution and host plants, and with special problems. An English synopsis accompanies each description, and maps are given of the ranges in Denmark of most of the species. Following the main descriptive text are tables showing the ranges of the species in Norway, Sweden, and Finland, and the seasonal occurrence and host associations of the species in Denmark.

The illustrations are of varied quality. The distributional maps are in general very clear. The coloured plates of larvae are rather crude, but those of adults are excellent. The drawings of genitalia are not technically perfect and appear to have suffered somewhat from excessive reduction, but they will undoubtedly be adequate for the recognition of the species. A very good feature is the provision of a table showing the origin of the specimen on which each illustration is based, and also the number of adults and of genitalic preparations studied of each species.

There are a short bibliography and an index to the species.

The general appearance of the volume is extremely attractive. It is well printed, on excellent paper, and is of handy size; the contents are very conveniently arranged. Much thought has evidently been devoted to the presentation as well as to the gathering of the material. The author seems thoroughly familiar with his subject, and the list of collaborators shows that he has spared no effort to obtain information from every possible source. I am unable to venture any opinion on the merits of his classification of the north-European forms, but it is gratifying to see that he separates as species such host-specific forms as *Eupithecia absinthiata* and *goosensiata*, which are so often given the unsatisfactory status of "biological races".

Because of the close relationship of the Palearctic and Nearctic faunas, this book will have considerable interest for North American lepidopterists, and will form a useful companion-piece to McDunnough's recent "Revision of the North American Species of the Genus *Eupithecia*".

EUGENE MUNROE

***Insects in Your Life:* By C. H. Curran. Pp. 316; with 16 plates and numerous text-figures. New York; Sheridan House; and Toronto; George J. McLeod, Ltd.: \$3.50.**

This volume is intended primarily for the layman, rather than for the professional entomologist or even for the serious amateur. It is, however, written in Dr. Curran's most entertaining manner, and contains a great deal of information that I found new and interesting.

Facts and anecdotes about a considerable variety of insects are presented, and a nice balance is maintained between species that are merely interesting and those that are of practical significance, and between familiar forms and those from far-off lands. Several chapters are devoted to household insects, and directions are given for some simple control measures which Dr. Curran has found to be effective.

The illustrations are the weakest feature of the book. The plates are for the most part satisfactory, but are poorly distributed, the illustrations in several cases being far away from the relevant text. The text-figures, on the other hand, are of very uneven quality: many are far from clear, and some, such as the figure of the spider beetle on p. 56, or that of the clothes moth on p. 71, are extremely poor. The figure on p. 247 appears to have been printed upside-down.

In general Dr. Curran's book will be found both readable and useful, and it will undoubtedly win a place on many bookshelves.

EUGENE MUNROE

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